REMARKS

Generally

The Examiner's suggestions regarding corrections to the drawings and specification are appreciated. The undersigned has attended to each suggestion, thereby clearing each objection and the rejection of Claims 21- 30 under 35 USC §112.

Regarding the rejection of Claims 21 – 30 under 35 USC §101, application of the PTO's own training materials with regard to "useful, concrete, and tangible" shows that the claimed invention meets these criteria.

Drawings

The OA requested that Figures 4, 8, 18-24, and 30 be corrected for stray lines and typographical errors. Each of these figures has been corrected. In addition to these corrections, the convention for distinguishing between regions involved in a Boolean operation has been revised. Earlier versions of this application used "bold" and "gray" as line characteristics for each region. This version of the application replaces the bold/gray convention with a solid/dashed convention that hopefully will retain the distinction between regions better in the issued patent and through multiple generations of photocopies. As a consequence, "B" and "G" [previously used in notations on the drawings to indicate bold and gray entrance/exit points associated with a (boundary, boundary) cell] have been replaced by "S" (solid) and "D" (dashed) respectively.

Specification

The OA noted five (5) typographical errors in the current specification – one of which the OA asserted is "new matter." Each of the typographical errors have been corrected. In addition, the specification has been amended to replace the bold/gray convention with the solid/dashed convention as described above with respect to the drawings. Given the wide distribution of the solid/dashed designators in the specification, a Revised Substitute Specification (in both redlined and clean versions) is provided with this Reply.

With regard to the asserted new matter, the equation in paragraph [0076] (a typographical error) has been replaced by the equation as originally filed.

Claim Rejections – 35 USC §112

The inadvertent change to the equation of paragraph [0076] from its as-filed form is cited by the OA as the basis for a rejection under 35 USC §112. As part of the correction to the specification, the equation in paragraph [0076] as been replaced by the equation as originally filed.

Claim Rejections – 35 USC §101

With regarding to Claims 21-30, the OA asserts:

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... it appears to be directed to the manipulation of an
abstract idea of performing Boolean operations for
(boundary, boundary) indexing cell only without resulting in
a practical application producing a concrete, useful, and
tangible result.
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... accumulating result tuples from the set operations on all
(boundary, boundary) indexing cells only does not appear to
be complete enough to produce a concrete, useful, and
tangible result in a practical application.
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Both statements amount to a summary rejection of the claims without application of analysis. Application of the PTO's own training materials[1] with regard to "useful, concrete, and tangible" shows that the claimed invention meets these criteria.

With regard to "useful:" the training materials state:

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a) the utility need not be expressly recited in the claims,
rather it may be inferred; (b) if the utility is not asserted
in the written description, then it must be well
established; ...
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[1] http://www.uspto.gov/web/menu/pbmethod/trangmaterials.ppt.

The claims positively recite the accumulation of *result tuples* that represent the product of a Boolean operation among a first and second region, e.g.:

> *21. A method for performing Boolean operations in a digital computer ...*
> **accumulating result tuples**, ...:
> *upon completing a cycle where at least one of a starting point remains*
> *untraversed or an intersection between region boundaries remains*
> *untraversed,* **accumulating result tuples**, ...
> **discarding duplicate tuples and tuples comprising only cell edges**, *until all*
> *starting points and intersections of the region boundaries have been*
> *traversed. ...*

That tuples that describe all or part of the result of a Boolean operation between two regions are useful is beyond doubt.

Further, there is no requirement that a claim recite steps well know to those skilled in the art. Methods for the accumulation of tuples in cells that are not (boundary, boundary) cells are well known; as are methods for concatenating tuples from each cell type to arrive at a final result. The specification makes this clear, e.g. (**bold** emphasis added):

> *[0015] Fig. 5 illustrates a categorical approach for analyzing set operations that was developed by the inventor herein and is described in Antony, R., Principles of Data Fusion Automation (Artech House, 1995). When set intersection exists, set operation generation is treated as a three-stage (sub-problem) process involving the following canonical form classes.*
> *[0016] Class 1: interactions between two interior cells;*
> *[0017] Class 2: interactions between a boundary and an interior cell; and*
> *[0018] Class 3: interactions between two boundary cells.*
> *[0019]* ***The first two stages entail only relatively trivial computations***, *and the appropriate methods for generating the products from both Class 1 and Class 2 are described in the Antony treatise, supra at 95. The third stage, however, is considerably more involved and effectively controls the computational complexity of the set operation generation process. Because both polylines and points can be treated as degenerate regions (regions with no "interior cells"), set union and intersection operations for these lower order features can be treated as a special case of the region generation methodology.*
> *[0020] Consequently, it would be greatly advantageous to provide an optimal method for generating the product of the third, and key stage of the procedure: Class 3 interactions between two boundary cells.*

As an independently sufficient basis for establishing the usefulness of the invention, the specification recites several examples of the utility of embodiments of the invention, e.g.,

> [0003] ... image processing, spatial data analysis, constraint-based reasoning, earth resource evaluation, crop management, market analysis studies, microfabrication, mining, weather forecasting, military planning, and utility management. For example, rain forest shrinkage over time can be studied by performing Boolean set intersections between processed earth resource imagery and historical vector-represented geo=spatial map products depicting vegetation. ... Ground-based target locations for military applications can often be significantly refined by intersecting sensor generated error ellipses with domain features that favor the presence of such vehicles ...

Here, in addition to the utility recited in the claims of *accumulating result tuples*, the written description contains several assertions of the utility of the invention.

With regard to "concrete," the PTO states (at the same source as above):

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Usually, this question <concreteness> arises when a result
cannot be assured.  An appropriate rejection … should be
accompanied by a lack of enablement (35 U.S.C. 112)
rejection, …
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The specification provides detailed disclosure illustrating that the results of computer program products and methods of the technology can be assured. In fact, the specification points out that establishing and classifying indexing cells about two regions is known.

> [0056] Two of the steps are known (Antony treatise, supra at 95), and these include the steps of: establishing indexing cells about the two subject regions; and 2) distinguishing three canonical form classes of indexing cells ...

The specification then provides detailed disclosure as to how each type of indexing cell is processed to perform a Boolean operation on the two regions.

The specification provides ample disclosure as to the assured nature of the results, i.e., concreteness.

With regard to "tangible," the PTO states (same materials as above):

... the examiner will determine whether there is simply a
mathematical construct claimed, such as a disembodied data
structure and method of making it. ... In contrast, a
claimed computer-readable medium encoded with a data
structure defines structural and functional
interrelationships between the data structure and the
computer software and hardware components which permits the
data structure's functionality to be realized, and is
statutory.

In Claims 21-25, a method *for performing Boolean operations in a digital computer* is claimed. In Claims 26-30, a *computer program product* including *a computer readable medium* and various *modules* is claimed. In each case, the claims explicitly call for an interrelationship between the data structure (e.g., regions represented as vector tuples), and the computer software and hardware components (e.g., a digital computer, a computer program product) which permit the data structure's functionality (e.g., vector tuple representation of the result of a Boolean operation between regions) to be realized, i.e., a tangible result.

In summary, the claimed invention does produce a useful, concrete, and tangible result in that the claims and the specification assert multiple utilities for assured results from interrelated data structure (e.g., regions represented as vector tuples), computer software (claimed steps and module functionality), and computer structure (e.g., digital computer/computer readable medium/modules) which permit functionality (e.g., vector tuple representation of the result of a Boolean operation between regions) to be realized.

For the above reasons, the undersigned requests that the rejection of Claims 21-30 as being directed to abstract ideas be withdrawn.

CONCLUSION

No new matter has been added to the disclosure. An examination on the merits at your earliest convenience is respectfully requested. Please contact undersigned with any questions that will expedite prosecution.

Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 50-1458, and please credit any excess fees to such deposit account.

Respectfully submitted,

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